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APPLICATION

FOR

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TITLE: FRAME SCALE PACKAGE USING CONTACT LINES THROUGH THE ELEMENTS

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FRAME SCALE PACKAGE USING CONTACT LINES THROUGH THE ELEMENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority from provisional application No. 60/245,085, filed November 1, 2000.

BACKGROUND

[0002] Many different systems are known for packaging integrated circuits. Standard packages come by many different names. However, many of these packages have the same object: to package an active part of an integrated circuit, a "die", in a way that protects the die, but also allows electrical communication to and from the die.

SUMMARY

[0003] The present application teaches a frame scale package which may hold the die around its edges and effectively frames the die. The system may have significant advantages, including better protection of the die against the environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] These and other aspects will now be described in detail with respect to the accompanying drawings wherein:

[0005] Figures 1A and 1B show respective side and top views of a first embodiment of a basic frame package for an image sensor;

[0006] Figure 2 shows a frame package side view with a lid;

[0007] Figure 3 shows a frame package with lid and having a lens mount; and

[0008] Figure 4 shows a totally sealed frame scale package with a lead and rear portion.

DETAILED DESCRIPTION

[0009] Figures 1A and 1B show a first embodiment of the frame scale package. Figure 1a shows the side view, showing the die element 100, which is an integrated circuit with an image sensor element integrated thereon. Preferably, the image sensor element is an active pixel sensor, of the type described in U.S. patent No. 5,471,215. As conventional, the die 100 includes contact portions 105 along an outer edge thereof, which enable electrical connection to the circuitry on the die. Electrical connection includes connections for power and signals.

[0010] The frame package is formed by an outer package element 120 which has an inner perimeter area 125 that is "stepped", which is to say that it has a first portion 126 which is slightly smaller than the die outer perimeter, and a thinned portion, where the thickness is reduced so that it can connect to the outer edges of the die. The outer perimeter 130 has a greater thickness than the inner perimeter, again with the difference in thicknesses being sufficient to accommodate the thickness of the die.

[0011] The outer surface of the frame includes a plurality of metal contact lines 140. The metal contact lines 140 may extend, as shown in Figure 1A and Figure 1B, from the outer perimeter 130 of the frame, along the bottom surface of the frame 132, along the step portion 133 of the inner perimeter of the frame, and along the bottom surface 134 of the inner portion of the frame. A connection 145 to the die 100 may be made at the location where the contact extends along the inner portion of the frame. The outer perimeter 140 also has a metal contact line, enabling a contact to be made at that frame package location.

[0012] The frame package may also be bonded to the printed circuit board along either or both of the surfaces 130,132.

[0013] Figure 1B shows how a plurality of contact areas for the printed circuit board lines may be provided. While the figure shows only a few contacts being made, of course there may be many more contacts.

[0014] In operation, the frame package forms a structure like a frame around the rectangular die. The bond pads on the die may contact the leads on the package via direct soldering rather than wire bonding, analogous to the way that connections are carried out in flip chip bonded die mounting. The leads in the frame scale package may also be soldered directly to a printed circuit board.

[0015] In figures 1A and 1B, an image sensor die 100 is placed face up into the package, and may fit snugly inside the inner perimeter of the package as shown. Since the package forms a frame around the die, portions of the package may contact the die at its outer edges. The die is prepared with solder bumps located on its bonded tabs in the areas 105.

[0016] Once the package is placed around the die, the system is heated to melt the solder bumps. This thereby bonds the die to the frame package leads. The leads of the package run from the die contacts, along the area on the underside of the package, and may also run out along the

outer perimeter of the package for lead bonding to the printed circuit board.

[0017] Other embodiments may provide other structures that associate with and protect or work with the die. The figure 2 embodiment includes a similar package which includes flanges on the frame package; not only at its bottom portion 210, but also at the top portion 220. The top frame 220 may receive a glass lid 230 which is separated from the die 100 by an air gap shown as 235. A protuberance 250 is a spot where the frame scale package extends above the level of the lid. This may be done to prevent the operative optical surface 232 of the lid from being scratched. The glass lid may be bonded to the lid in conventional ways, such as with a silicon sealant.

[0018] Figure 3 shows an alternative frame package which includes an additional threaded area 300 above the die 100 and glass lid 230. The additional area 300 has inner threads, which are threaded to accept a lens. In this way, a lens may be mounted within the package, associated with the die. For example, this may enable focusing of certain incoming rays to the die. While this embodiment shows the inner surfaces as being threaded, it should be understood that other surface features could be used alternatively to hold the lens in place.

[0019] Figure 4 shows an alternative embodiment in which the frame scale package includes multiple indentations, one of which forms a backing portion for the die. The backing portion 400 is located behind the die 100. In this embodiment, the frame 420 includes a first indentation portion 422 which is sized to accept the backing portion 400. The second indentation portion 424 is sized to accept the die 100. The leads 426 are similar to those in the previous embodiment, but in addition, may travel along the two indented portions 422,424. The back plate may allow better sealing of the die against the environment.

[0020] Although only a few embodiments have been disclosed in detail above, other modifications are possible. All such modifications are intended to be encompassed within the following claims.